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PATENT ABSTRACTS OF JAPAN

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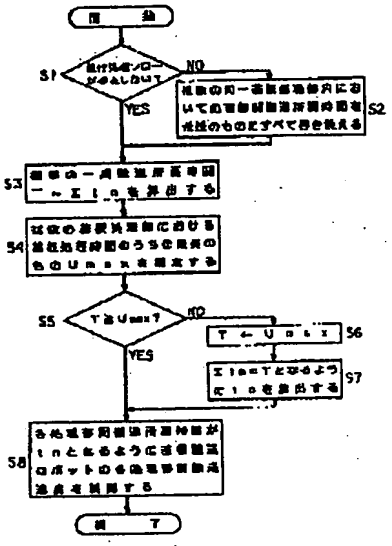
(54) METHOD AND DEVICE FOR TREATING SUBSTRATE

(57)Abstract:



PROBLEM TO BE SOLVED: To make the treating hystereses of a plurality of substrates in the same lot equal to each other even when a substrate treating section which requires long substrate treating time as compared with the time required by a substrate transporting robot for making a round trip through a plurality of substrate treating sections without waiting by performing required treatment on a substrate transporting means for the substrate treating sections.

SOLUTION: When, for example, a parallel treatment flow exists and the longest substrate treating time is longer than a standard round transporting time, the parallel treatment flow is discriminated (S1) and the standard transporting time is rewritten (S2). Then the standard time required by a substrate transporting robot for making a round trip through a plurality of substrate treating sections is calculated (S3) and the longest substrate treating time is selected from among of the substrate treating time of the substrate treating sections (S4). The standard time required by the robot for making one round trip through the substrate treating sections is compared with the longest substrate treating time (S5) and the time required by the robot for making one round trip is rewritten (S6 and S7). Then the substrate transporting speed of the robot is controlled.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the substrate processor used for the substrate art which conveys one substrate, such as two or more semiconductor substrates, at a time one by one to each substrate processing section, and performs necessary processing to a substrate, respectively, and a row although the method is enforced, carrying out circulation movement of the substrate conveyance means in predetermined sequence to two or more substrate processing sections.
[0002]
[Description of the Prior Art] In the substrate processor which has two or more substrate processing sections, and performs two or more processings one by one to substrates, such as a semiconductor substrate, circulation movement of a substrate conveyance means, for example, the single self-propelled substrate carrier robot, is carried out in predetermined sequence to two or more substrate processing sections, and it conveys two or more one substrate at a time one by one to each substrate processing section by the substrate carrier robot, and is made to perform necessary processing in each substrate processing section to a substrate, respectively.
[0003] In a substrate processor, a substrate carrier robot conveys a substrate from the substrate processing section to the following substrate processing section according to the conveyance capacity. Namely, a substrate carrier robot demonstrates the maximum conveyance capacity, moves by constant speed, and conveys the substrate from the substrate processing section to the following substrate processing section in predetermined conveyance time according to the mileage between services between each substrate processing section, respectively. Here at the conveyance time between each substrate processing section The time which drawing of the substrate in the substrate processing section and the injection of a substrate take is included. the conveyance time of the substrate from the substrate processing section to the following substrate processing section It is total with the time taken to supply a substrate to the substrate processing section by the substrate carrier robot, the time which a substrate carrier robot takes to move to the following substrate processing section from the substrate processing section, and the time taken to take out the following substrate processing section to a substrate by the substrate carrier robot.
[0004]
[Problem(s) to be Solved by the Invention] By the way, it will stand by until processing ends a substrate carrier robot in front of the substrate processing section in the long substrate processing section of the substrate processing time compared with time for a substrate carrier robot to take a round of two or more substrate processing sections. And after processing is completed, a substrate is taken out from the substrate processing section, the following substrate is supplied to the substrate processing section, and it moves towards the following substrate processing section. In this case, the time which the same drive operation of the same mechanical component in each substrate processing section, such as vertical movement of the pin for substrate delivery prepared in opening and closing of the shutter of the substrate output port of the substrate processing section or the substrate processing section and vertical movement of a cup (when the substrate processing section is the coating processing section etc.), takes, for example is not necessarily fixed. For example, if the pneumatic cylinder is used for a mechanical component, it is difficult to control

strictly time, such as opening and closing of a shutter, and vertical movement of a pin. Consequently, there is a problem that the standby time of the substrate carrier robot in front of the substrate processing section will also be different small [every] whenever a substrate carrier robot takes a round of two or more substrate processing sections (every conveyance cycle). And this problem becomes more remarkable, as the number of the substrate processing sections which needs standby of a substrate carrier robot increases, and when processing histories, such as the heat history, will differ for every substrate and the processing quality of a substrate is managed also by two or more substrates of the same lot, it poses a big problem.

[0005] Moreover, as an outline plan is shown, for example in drawing 8 , while taking out at a time from a cassette one substrate which the cassette (not shown) which can contain two or more substrates is laid, and it is going to process and taking it out The cassette stage S which receives at a time one substrate which finished all processings, and is again contained to a cassette (indexer) In the substrate processor constituted from two or more substrate processing sections A, B, C1, C2, and D by the conveyance unit T in which the self-propelled substrate carrier robot (not shown) equipped with the arm for a substrate transfer was arranged, and the row As the flow view of processing was shown in drawing 9 , when the substrate processing section C1 and the substrate processing section C2 performed the same processing in parallel on the same processing conditions, there were the following troubles in the conventional substrate processor. In addition, the cassette stage S performs processing called receipt of the substrate to drawing and the cassette of a substrate from a cassette, and the cassette stage S is one of the substrate processing sections.

[0006] In the processing flow shown in drawing 9 The now and cassette stage S and the substrate processing section A Each substrate processing time in B, C1, C2, and D 20 seconds, 22 seconds, It considers as 30 seconds, 40 seconds, 40 seconds, and 20 seconds. Between the cassette stage S and the substrate processing sections A, Conveyance time of each substrate between substrate processing section A-B, between substrate processing section B-C1, between substrate processing section C1-D, between substrate processing section C2-D, and between the substrate processing section D and the cassette stage S is made into 3 seconds, 4 seconds, 5 seconds, 3 seconds, 5 seconds, 3 seconds, and 5 seconds. In this processing flow as a processing path of a substrate Cassette stage S-> substrate processing section A-> substrate processing section B-> substrate processing section C1 -> substrate processing section D-> cassette stage S and the path of which a round is taken (henceforth "Path a"), There are two kinds of things of cassette stage S-> substrate processing section A-> substrate processing section B-> substrate processing section C2 -> substrate processing section D-> cassette stage S and the path (henceforth "Path b") of which a round is taken. In these Paths a and Paths b, although the processing program in each substrate processing section is completely the same respectively, since the mileage between services of a substrate differs somewhat, the time taken for a substrate carrier robot to take a round of a path is different in both paths, and becomes 18 seconds by Path b for 22 seconds in Path a. In addition, this time is a thing when presupposing that a substrate carrier robot does not stand by to which the substrate processing section (the cassette stage S is included).

[0007] On the other hand, if it sees about the substrate processing section B, in the substrate processing section B, processing of a substrate will take the time for 30 seconds. That is, after supplying the substrate before processing to the substrate processing section B, before becoming possible to take out the substrate from the substrate processing section B, and to supply the following unsettled substrate to the substrate processing section B, it will take the time for 30 seconds. Therefore, 22 seconds after a substrate carrier robot supplies a substrate to the substrate processing section B and taking a round of Path a, even if it returns to the substrate processing section B front for exchange of a substrate, processing of the substrate in the substrate processing section B is not ended. For this reason, by the time a substrate carrier robot supplies drawing of a substrate, and the following substrate, you have to wait for it in front of the substrate processing section B for 8 seconds (it is 12 seconds when a round is taken of Path b). That is, by the processing flow shown in drawing 9 , the substrate processing time in the substrate processing section B with the longest substrate processing time will carry out rate controlling, and a substrate carrier robot will take a round of Paths a and b in a cycle of 30 seconds, respectively. In addition,

in the substrate processing sections C1 and C2, since the same processing is performed in parallel, the substrate processing time becomes 20 seconds (=40 second /2) seemingly.
[0008] Although a substrate carrier robot takes a round of Paths a and b in a cycle of 30 seconds, if there is time for 30 seconds, processing will be completed also in which the substrate processing section (the cassette stage S is included). For this reason, a substrate carrier robot continues operating, without standing by also to which the substrate processing section (a cassette stage being included) except the substrate processing section B until it returns to the substrate processing section B front in order to take out a substrate [finishing / processing], after a substrate carrier robot supplies a substrate to the substrate processing section B (receipts and payments of a substrate to movement between the substrate processing sections, and the substrate processing section). When it sees about the relation between the substrate processing sections C1 and C2 and the substrate processing section D, then, in Path a After processing a substrate for 40 seconds in the substrate processing section C1, processing of the substrate in the substrate processing section D is started after the 5 seconds, and in Path b, after processing a substrate for 40 seconds in the substrate processing section C2, processing of the substrate in the substrate processing section D will be started after the 3 seconds.
[0009] In the heat-treatment section which the substrate processing sections C1 and C2 equipped with the hot plate, when the substrate processing section D is the cooling processing section equipped with the cool plate, here Even if it completely heats a substrate by the same heating program in the substrate processing sections C1 and C2, respectively, although cooling processing is started 45 seconds after starting heat-treatment, in Path a, by the difference in the conveyance time of the substrate from the substrate processing sections C1 and C2 to the substrate processing section D In Path b, cooling processing will be started after [of a heat-treatment start] 43 seconds. Consequently, the heat history of a substrate will be different in Path a and Path b, and the homogeneity of the processing quality of a substrate will be influenced. Although a chemistry amplification type resist is especially used in a semiconductor manufacture process recently When a chemistry amplification type resist is used, in order to heat a semiconductor substrate, to promote the reaction of an exposure portion, to cool a semiconductor substrate after that and to make it stop a reaction before after [exposure] development, When the time from a heat-treatment start to a cooling processing start differs, the reaction time in a chemistry amplification type resist will be different, and a big difference will be produced in a development result. For this reason, it becomes a big problem when processing quality will differ by what was processed in Path a, and the thing processed in Path b and processing quality is managed about two or more semiconductor substrates of the same lot.
[0010] This invention being made in view of the above situations, and carrying out circulation movement of the substrate conveyance means in predetermined sequence to two or more substrate processing sections [when conveying two or more one substrate at a time one by one to each substrate processing section and performing necessary processing to a substrate, respectively] Even if the long substrate processing section of the substrate processing time is contained compared with time to take a round of two or more substrate processing sections, without a substrate conveyance means standing by also to any of two or more substrate processing sections Even if two or more same substrate processing sections which the processing history of two or more substrates of the same lot becomes equal, and perform the same processing in parallel on the same processing conditions are contained Irrespective of a processing path, the processing history of two or more substrates of the same lot becomes equal, it is easy and management of processing quality aims at providing offering the substrate art which can raise the product yield, and a row with the substrate processor which can enforce such a method.
[0011]
[Means for Solving the Problem] Invention driven to a claim 1, carrying out circulation movement of the substrate conveyance means in predetermined sequence to two or more substrate processing sections In the substrate art which conveys two or more one substrate at a time one by one to each substrate processing section by the substrate conveyance means, and performs necessary processing to a substrate, respectively in each substrate processing section A round conveyance

duration usually taken to convey a substrate at predetermined speed and to take a round of two or more substrate processing sections, without the aforementioned substrate conveyance means standing by also to any of two or more aforementioned substrate processing sections When shorter than the longest substrate processing time of the substrate processing times in two or more substrate processing sections An actual round conveyance duration to which a substrate conveyance means takes a round of two or more substrate processing sections is characterized by equivalent to the aforementioned longest substrate processing time, or controlling the bearer rate of the substrate by the substrate conveyance means so that it may become more than it.

[0012] Receive a round conveyance duration usually taken for a substrate conveyance means to convey a substrate at predetermined speed, and for invention concerning a claim 2 to take a round of two or more substrate processing sections in a substrate art according to claim 1. The ratio of the longest substrate processing time of the substrate processing times in two or more substrate processing sections is computed. It is characterized by delaying each actual processing sections conveyance duration a substrate has between each substrate processing section conveyed by the aforementioned substrate conveyance means by the aforementioned ratio to each usual processing sections conveyance duration from which a substrate is conveyed at predetermined speed in between each substrate processing section, respectively by the substrate conveyance means.

[0013] Invention is set to a claim 3 at a substrate art according to claim 1 or 2. When two or more same substrate processing sections which perform the same processing in parallel on the same processing conditions into two or more substrate processing sections are contained It considers as the time which **(ed) the actual substrate processing time [in / the one same substrate processing section / for the substrate processing time in the same aforementioned substrate processing section] by the number of the same substrate processing sections. While making respectively the same each actual processing sections conveyance duration which conveys a substrate by the substrate conveyance means to each same substrate processing section, respectively from the substrate processing section of one upstream of the same aforementioned substrate processing section It is characterized by making respectively the same each actual processing sections conveyance duration which conveys a substrate by the substrate conveyance means, respectively to the substrate processing section of one downstream of each same substrate processing section to the same substrate processing section.

[0014] Invention concerning a claim 4 is equipped with the substrate conveyance means which carries out circulation movement in predetermined sequence to two or more substrate processing sections and the substrate processing section of these plurality. In the substrate processor which conveys two or more one substrate at a time one by one to each aforementioned substrate processing section by the aforementioned substrate conveyance means, and performs necessary processing to a substrate, respectively in each substrate processing section So that it may become that an actual round conveyance duration which takes a round of two or more aforementioned substrate processing sections has the aforementioned substrate conveyance means equivalent to the longest substrate processing time of the substrate processing times in two or more substrate processing sections, or more than it It is characterized by establishing a substrate transfer-control means to control the bearer rate of the substrate by the substrate conveyance means.

[0015] A means to compute a round conveyance duration usually taken for invention concerning a claim 5 to convey a substrate at predetermined speed, and to take a round of two or more substrate processing sections in a substrate processor according to claim 4, without a substrate conveyance means standing by also to any of two or more substrate processing sections, A means to compare the aforementioned round conveyance duration with the aforementioned longest substrate processing time, and when the aforementioned round conveyance duration is shorter than the aforementioned longest substrate processing time Compute the ratio of the longest substrate processing time over a round conveyance duration, and each usual processing sections conveyance duration from which a substrate is conveyed at predetermined speed in between each substrate processing section by the aforementioned substrate conveyance means is multiplied by the aforementioned ratio, respectively. A means to compute each actual processing sections conveyance duration a substrate has between each substrate processing section conveyed by the

substrate conveyance means A substrate transfer-control means has, and when the aforementioned round conveyance duration is longer than the aforementioned longest substrate processing time, it is each aforementioned usual processing sections conveyance duration. When the aforementioned round conveyance duration is shorter than the aforementioned longest substrate processing time, it is each processing sections conveyance duration of the aforementioned practice, and it is characterized by conveying a substrate in between each substrate processing section by the aforementioned substrate conveyance means, respectively.

[0016] Invention concerning a claim 6 is set to a substrate processor according to claim 4 or 5. When two or more same substrate processing sections which perform the same processing in parallel on the same processing conditions into two or more substrate processing sections are contained It considers as the time which **(ed) the actual substrate processing time [in / the one same substrate processing section / for the substrate processing time in the same aforementioned substrate processing section] by the number of the same substrate processing sections. Each usual processing sections conveyance duration which conveys a substrate by the substrate conveyance means to each same substrate processing section, respectively from the substrate processing section of one upstream of the same aforementioned substrate processing section While rewriting to the longest thing of these processing sections conveyance durations, respectively Each usual processing sections conveyance duration which conveys a substrate by the substrate conveyance means, respectively to the substrate processing section of one downstream of each same substrate processing section to the same substrate processing section It is characterized by what the substrate transfer-control means equipped the longest thing of these processing sections conveyance durations with the means rewritten, respectively for.

[0017] In the substrate art of invention concerning a claim 1, when the long substrate processing section of the substrate processing time is contained compared with time to take a round of two or more substrate processing sections, without a substrate conveyance means standing by also to any of two or more substrate processing sections, it is controlled so that the bearer rate of the substrate by the substrate conveyance means becomes slow, and time for a substrate conveyance means to take a round of two or more substrate processing sections becomes equivalent to the longest substrate processing time, or more than it. Therefore, a substrate conveyance means continues conveying a substrate, without standing by in front of it like before also to which the substrate processing section. For this reason, possibility of having said that the standby time of a substrate conveyance means was different small [every] for every conveyance cycle, and produced a difference in a processing history between the substrates of the plurality of the same lot disappears. Moreover, even if two or more same substrate processing sections which perform the same processing in parallel on the same processing conditions are contained, in order to continue conveying a substrate, without a substrate processing means standing by also to which the substrate processing section, each time to which a substrate conveyance means conveys a substrate from each of two or more same substrate processing sections to the following substrate processing section, respectively will simultaneously be in agreement and in agreement. For this reason, possibility of having said that a difference was produced in a processing history between the substrates of the plurality of the same lot by the difference in a processing path disappears, or it decreases.

[0018] Since the conveyance time of the substrate between each substrate processing section by the substrate conveyance means is delayed in the substrate art of invention concerning a claim 2 by the respectively fixed ratio, the bearer rate of the substrate by the substrate conveyance means becomes regularity or simultaneously regularity.

[0019] In the substrate art of invention concerning a claim 3, each time to which a substrate conveyance means conveys a substrate from each of two or more same substrate processing sections to the following substrate processing section, respectively will be completely in agreement. For this reason, possibility of having said that a difference was produced in a processing history between the substrates of the plurality of the same lot by the difference in a processing path completely disappears.

[0020] When processing a substrate using the substrate processor of invention concerning a claim

4 Even if the long substrate processing section of the substrate processing time is contained compared with time to take a round of two or more substrate processing sections, without a substrate conveyance means standing by also to any of two or more substrate processing sections It is controlled by the substrate transfer-control means so that the bearer rate of the substrate by the substrate conveyance means becomes slow, and the above-mentioned operation of that time for a substrate conveyance means to take a round of two or more substrate processing sections is equivalent to the longest substrate processing time or invention which becomes more than it and relates to a claim 1 is done so.

[0021] When processing a substrate using the equipment of invention concerning a claim 5 A round conveyance duration usually taken to convey a substrate at predetermined speed and to take a round of two or more substrate processing sections by the substrate transfer-control means, without a substrate conveyance means standing by also to any of two or more substrate processing sections is computed. The aforementioned round conveyance duration is compared with the aforementioned longest substrate processing time. when the aforementioned round conveyance duration is shorter than the aforementioned longest substrate processing time The ratio of the longest substrate processing time over a round conveyance duration is computed, and each usual processing sections conveyance duration from which a substrate is conveyed at predetermined speed in between each substrate processing section by the substrate conveyance means is multiplied by the aforementioned ratio, respectively. Each actual processing sections conveyance duration a substrate has between each substrate processing section conveyed by the substrate conveyance means is computed. And the bearer rate of a substrate is controlled by the substrate transfer-control means, and when the aforementioned round conveyance duration is longer than the longest substrate processing time, it is each aforementioned usual processing sections conveyance duration, when a round conveyance duration is shorter than the longest substrate processing time, it is each processing sections conveyance duration of the aforementioned practice, and a substrate is conveyed in between each substrate processing section by the substrate conveyance means, respectively.

[0022] When processing a substrate using the equipment of invention concerning a claim 6 By the substrate transfer-control means, each usual processing sections conveyance duration which conveys a substrate from the substrate processing section of one upstream of the same substrate processing section by the substrate conveyance means to each same substrate processing section, respectively While being rewritten by the longest thing of these processing sections conveyance durations, respectively Each usual processing sections conveyance duration which conveys a substrate by the substrate conveyance means, respectively to the substrate processing section of one downstream of each same substrate processing section to the same substrate processing section is rewritten by the longest thing of these processing sections conveyance durations, respectively. Therefore, possibility of having said that each time to which a substrate conveyance means conveys a substrate from each of two or more same substrate processing sections to the following substrate processing section, respectively would be completely in agreement, and a difference was produced in a processing history between the substrates of the plurality of the same lot by the difference in a processing path for this reason completely disappears.

[0023]

[Embodiments of the Invention] It explains referring to drawing 1 or drawing 7 about the suitable operation gestalt of this invention hereafter.

[0024] The block diagram and drawing 3 which show one example of the composition of the substrate processor used in order that first drawing 2 may enforce the substrate art concerning this invention are the outline plan of the equipment, and explain the outline composition of equipment with these drawings. This substrate processor consists of the six substrate processing sections and conveyance units 22 like the equipment shown in drawing 8 including the cassette stage 10. It has the function which receives at a time one substrate 1 which two or more cassettes 2 which can contain two or more substrates 1, for example, semiconductor substrates, were laid in the cassette stage 10, and took out at a time one substrate 1 which it is going to process from the cassette 2, and supplied the conveyance unit 22, and finished all processings from the conveyance unit 22,

and is again contained to a cassette 2. Two or more of other substrate processing sections of this cassette stage 10 For example, the pretreatment section 12 (for example, after heating a substrate with a hot plate, processing cooled on a cool plate is performed), the coating processing section 14 equipped with the spin coater 24, and the two heat-treatment sections 16 and 18 which are equipped with a hot plate (not shown), respectively and perform the same heat-treatment in parallel on the same processing conditions -- and It is the cooling processing section 20 which cools the semiconductor substrate which was equipped with the cool plate (not shown) and carried out the temperature rise by heat-treatment. Moreover, the conveyance units 22 are all the substrate processing sections (the cassette stage 10 is included.). Hereafter, it is the same. It is arranged so that it may face, and it has the single self-propelled substrate carrier robot 26, and the substrate carrier robot has an object for substrate drawing, and two substrate transfer arms 28 for a substrate injection in a top and the bottom.

[0025] Conveyance operation of the substrate carrier robot 26 is performed by the stepping motor 30, the motor driver 32 which makes a stepping motor 30 drive is controlled by the control signal from CPU34, and the bearer rate of the substrate by the substrate carrier robot 26 is changed by change of the pulse rate (a pulse number/second) of a stepping motor 30. Moreover, generalization control also of the processing in each substrate processing section including the cassette stage 10 is carried out by CPU34. Furthermore, data processing which is mentioned later is also performed in CPU34. The data which the input and setup of the processing program of the substrate processing time in each substrate processing section, each processing sections conveyance duration the semiconductor substrate 1 has between each substrate processing section conveyed by the substrate carrier robot 26, and a substrate etc. were performed considering the keyboard 36 or the display 38 as an I/O device, and were inputted, the set-up processing program are memorized by memory 40.

[0026] If a series of down stream processing of the semiconductor substrate 1 is explained briefly, one semiconductor substrate 1 before the processing contained by the cassette 2 from the cassette stage 10 will be first supplied at a time to the conveyance unit 22, and a substrate 1 will be laid in one arm 28 of the substrate carrier robot 26. Next, the substrate carrier robot 26 moves to the pretreatment section 12 front, and takes out the substrate 1 which was contained previously from the pretreatment section 12 by the arm 28 of another side. And the substrate 1 laid on one arm 28 is supplied to the pretreatment section 12 which changed into the empty state. Then, the substrate carrier robot 26 moves to the coating processing section 14 front, the substrate 1 to which the resist was applied is taken out from the coating processing section 14 by one arm 28, and the substrate 1 laid on the arm 28 of another side is supplied to the coating processing section 14 which changed into the empty state. Henceforth, the substrate carrier robot 26 performs drawing of a substrate 1, and an injection by the substrate carrier robot 26 similarly, moving to the cooling processing section 20 from the heat-treatment section 16 (or heat-treatment section 18) from the coating processing section 14 to the heat-treatment section 16 (or heat-treatment section 18). And the substrate carrier robot 26 moves to the cassette stage 10 from the cooling processing section 20, the substrate 1 which finished all processings is passed to the cassette stage 10 from the conveyance unit 22, and the substrate [finishing / processing into the cassette 2 on the cassette stage 10] 1 is contained. Thus, while the substrate carrier robot 26 carries out circulation movement of between each substrate processing section, a substrate 1 is conveyed, a substrate 1 is processed in each substrate processing section, respectively, and the substrate [finishing / processing] 1 is contained one by one into the cassette 2.

[0027] Next, the determination method of the conveyance conditions of the substrate in this substrate processor and the control method of the bearer rate of the substrate by the substrate carrier robot 26 are explained. If the substrate processing time in each substrate processing section and the standard conveyance duration of the substrate 1 between each substrate processing section are inputted using a keyboard 36 etc., data processing as showed the flow chart to drawing 1 in CPU34 will be performed, and an actual processing sections conveyance duration will be computed. And based on the processing sections conveyance duration, a control signal is sent to the motor driver 32 from CPU34, a stepping motor 30 drives and the bearer rate of the substrate by the substrate carrier robot 26 is controlled by the motor driver 32. Below, in the case of four, it

divides, and explains.

[0028] The [time [the longest substrate processing time is / that a parallel-processing flow exists / longer than a standard round conveyance duration]] for example Each substrate processing time in the cassette stage 10, the pretreatment section 12, the coating processing section 14, the heat-treatment sections 16 and 18, and the cooling processing section 20 as well as the processing flow shown in drawing 9 They are 20 seconds, 22 seconds, 30 seconds, 40 seconds, and 20 seconds. The cassette stage 10 -> pretreatment section 12, the pretreatment section 12 -> coating processing section 14, the coating processing section 14 -> heat-treatment section 16, the coating processing section 14 -> heat-treatment section 18, the heat-treatment section 16 -> cooling processing section 20, the heat-treatment section 18 -> cooling processing section 20, Each standard conveyance duration of the cooling processing section 20 -> cassette stage 10 When it is t1= 3 seconds, t2= 4 seconds, t3= 5 seconds, t4= 3 seconds, t5= 5 seconds, t6= 3 seconds, and t7= 5 seconds, after distinguishing whether a parallel-processing flow exists at Step S1, it is Step S2 and rewrites with t4=t3= 5 seconds, and t6=t5= 5 seconds. Next, the substrate carrier robot 26 computes the round conveyance duration T=t1+t2+t3(t4)+t5(t6)+t7=22 second of the standard taken to take a round of two or more substrate processing sections (Step S3). Moreover, the longest thing Umax of the substrate processing times in two or more substrate processing sections is selected (step S4). In this example, the substrate processing time in the coating processing section 14 is the longest, and is Umax= 30 seconds.

[0029] Next, Step S5 compares a standard round conveyance duration T and the longest substrate processing time Umax. In this case, since it is T(= 22 seconds) <Umax (= 30 seconds), it rewrites with round conveyance duration T=Umax= 30 seconds at Step S6. And as it has been sigmatn=T= 30 seconds, each actual processing sections conveyance durations t1-t7 are computed (Step S7). This calculation computes the ratio r (=30 / 22**1.37) of an actual round conveyance duration (longest substrate processing-time Umax= 30 seconds) over a standard round conveyance duration (= 22 seconds), and is performed by multiplying each standard processing sections conveyance durations t1-t7 by the ratio, respectively. Consequently, each actual processing sections conveyance duration tn becomes t1** 4.2 seconds, t2** 5.5 seconds, t3=t4** 6.9 seconds, t5=t6** 6.9 seconds, and t7** 6.9 seconds (T=sigma tn= 30.4 seconds). And to be set to tn by which each processing sections conveyance duration was computed, the control signal which changes the pulse rate (a pulse number/second) of a stepping motor 30 from CPU34 is sent to the motor driver 32, a stepping motor 30 drives and the bearer rate of the substrate by the substrate carrier robot 26 is controlled by the motor driver 32. This processing flow is shown in drawing 4 .

[0030] The [time [a standard round conveyance duration is / that a parallel-processing flow exists / longer than the longest substrate processing time]] Each substrate processing time in the cassette stage 10, the pretreatment section 12, the coating processing section 14, the heat-treatment sections 16 and 18, and the cooling processing section 20 For example, 20 seconds, 20 seconds, It is 20 seconds, 40 seconds, 40 seconds, and 20 seconds, and when each standard processing sections conveyance duration is the same as the above, after distinguishing whether a parallel-processing flow exists at Step 1, it is Step S2 and rewrites with t4=t3= 5 seconds, and t6=t5= 5 seconds. Next, the round conveyance duration T=t1+t2+t3(t4)+t5(t6)+t7=22 second of the standard taken for the substrate carrier robot 26 to take a round of two or more substrate processing sections is computed (Step S3). The longest thing Umax of the substrate processing times in two or more substrate processing sections (Umax= 20 seconds after the substrate processing time in all the substrate processing sections is 20 seconds in this example) is selected (Step 4). Next, in this case, although Step S5 compares a standard round conveyance duration T and the longest substrate processing time Umax, since it is T(= 22 seconds) >Umax (= 20 seconds), it moves to Step S8 as it is. And the bearer rate of the substrate by the substrate carrier robot 26 is controlled so that each processing sections conveyance duration tn becomes t1= 3 seconds, t2= 4 seconds, t3=t4= 5 seconds, t5=t6= 5 seconds, and t7= 5 seconds. This processing flow is shown in drawing 5 .

[0031] The [time [the longest substrate processing time is / that a parallel-processing flow does not exist but / longer than a standard round conveyance duration]] Next, unlike the case where it

describes above, as a processing flow is shown in drawing 6 , the case where only the single heat-treatment section 16 is formed is considered. For example, each substrate processing time in the cassette stage 10, the pretreatment section 12, the coating processing section 14, the heat-treatment section 16, and the cooling processing section 20 They are 20 seconds, 22 seconds, 30 seconds, 30 seconds, and 20 seconds. Each standard conveyance duration of the cassette stage 10 -> pretreatment section 12, the pretreatment section 12 -> coating processing section 14, the coating processing section 14 -> heat-treatment section 16, the heat-treatment section 16 -> cooling processing section 20, and the cooling processing section 20 -> cassette stage 10 t1= 3 seconds, t2= 4 seconds, The result which distinguished whether a parallel-processing flow would exist at Step S1 when it was t3= 5 seconds, t5= 5 seconds, and t7= 5 seconds, Move to Step S3 then and the round conveyance duration T=t1+t2+t3+t5+t7=22 second of the standard taken for the substrate carrier robot 26 to take a round of two or more substrate processing sections is computed (Step S3). The longest thing Umax of the substrate processing times in two or more substrate processing sections is selected (Step 4). In this example, each substrate processing time in the coating processing section 14 and the heat-treatment section 16 is the longest, and is Umax= 30 seconds. Next, Step S5 compares a standard round conveyance duration T and the longest substrate processing time Umax, and in this case, since it is T(= 22 seconds) <Umax (= 30 seconds), it rewrites with round conveyance duration T=Umax= 30 seconds at Step S6. And as it has been sigmatn=T= 30 seconds, each actual processing sections conveyance durations t1, t2, t3, t5, and t7 are computed like the above (Step S7). Consequently, each actual processing sections conveyance duration tn becomes t1** 4.2 seconds, t2** 5.5 seconds, t3** 6.9 seconds, t5** 6.9 seconds, and t7** 6.9 seconds. And to be set to tn by which each processing sections conveyance duration was computed, the control signal which changes the pulse rate (pulse ** / second) of a stepping motor 30 into the motor driver 32 from CPU34 is sent, and the bearer rate of the substrate by the substrate carrier robot 26 is controlled.

[0032] The [time [a standard round conveyance duration is / that a parallel-processing flow does not exist but / longer than the longest substrate processing time]] As a processing flow is shown in drawing 7 The substrate processing time in two or more substrate processing sections is 20 seconds, respectively. when each standard processing sections conveyance duration is the same as the above Step S1->S3->S4->S5-> The substrate bearer rate by the substrate carrier robot 26 is controlled by the flow of S8 so that a substrate 1 is conveyed in between each substrate processing section with the standard conveyance duration by which the setting input was carried out.

[0033] In addition, in the gestalt of the above-mentioned implementation, it hits computing each actual processing sections conveyance durations t1-t7. Although the ratio r of the longest substrate processing time Umax over a standard round conveyance duration T is computed and it is made to multiply each standard processing sections conveyance durations t1-t7 by the ratio r, respectively By adding the time of the difference of a standard round conveyance duration T and the longest substrate processing time Umax to one of time not among the thing restricted to this but among each standard processing sections conveyance durations t1-t7 You may make it compute each actual processing sections conveyance durations t1-t7.

[0034] Moreover, this invention is applicable also to the composition equipped with the heat-treatment section which performs the so-called post exposure BEKU to the substrate after exposure as two or more substrate processing sections, and the cooling processing section which cools the substrate heated by this heat-treatment section. In this case, the history of heat treatment can be made regularity among two or more substrates, and processing quality can be made regularity.

[0035]

[Effect of the Invention] When processing [and] a substrate using the equipment of invention concerning a claim 4 according to the substrate art of invention concerning a claim 1 Carrying out circulation movement of the substrate conveyance means in predetermined sequence to two or more substrate processing sections When conveying two or more one substrate at a time one by one to each substrate processing section and performing necessary processing to a substrate, respectively Even if the long substrate processing section of the substrate processing time is

contained compared with time to take a round of two or more substrate processing sections, without a substrate conveyance means standing by also to any of two or more substrate processing sections Since a substrate conveyance means continues conveying a substrate, without standing by in front of it also to which the substrate processing section Though the time which drive operation of opening and closing of the shutter of the substrate output port of the substrate processing section, vertical movement of the pin for substrate delivery, etc. takes is somewhat different for every conveyance cycle, it does not influence the processing history of a substrate, and the processing history of two or more substrates of the same lot becomes equal. Moreover, even if two or more same substrate processing sections which perform the same processing in parallel on the same processing conditions are contained, there is no possibility of having said that a difference was produced in a processing history between the substrates of the plurality of the same lot by the difference in a processing path, or it is few. Therefore, management of processing quality becomes easy, dispersion in processing quality is improved, and the product yield improves.

[0036] In the substrate art of invention concerning a claim 2, when processing a substrate using the equipment of invention concerning a claim 5, the conveyance time of the substrate between each substrate processing section by the substrate conveyance means is delayed by the respectively fixed ratio, and the bearer rate of the substrate by the substrate conveyance means becomes regularity or simultaneously regularity.

[0037] In the substrate art of invention concerning a claim 3, since possibility said that a difference was produced in a processing history between the substrates of the plurality of the same lot by the difference in a processing path completely disappears when processing a substrate using the equipment of invention concerning a claim 6, the above-mentioned effect of each invention concerning a claim 1 and a claim 4 is acquired certainly.

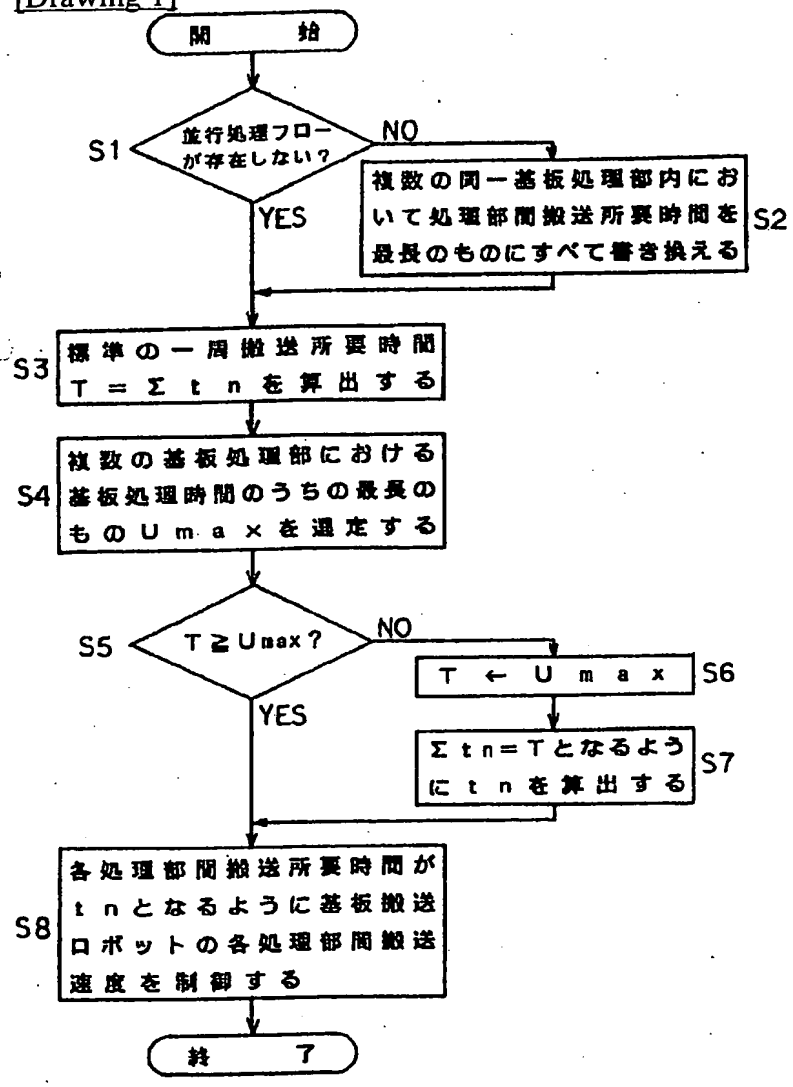
[Translation done.]

* NOTICES *

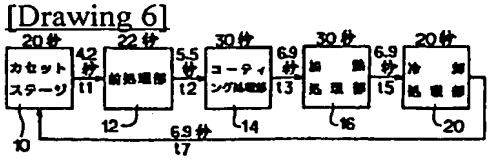
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

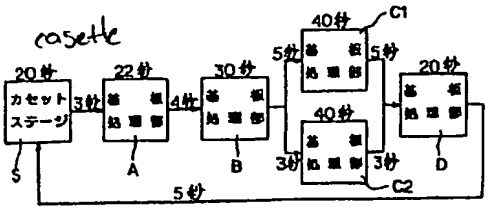
[Drawing 1]



[Drawing 6]



[Drawing 7]



[Translation done.]